Survey on Skills Development in Ethiopian Garment Production Sector

Shoko Yamada, Nagoya University
Christian Otchia, Nagoya University
Kyoko Taniguchi, Hiroshima University

Background

- Urban youth unemployment rate was 24 percent in 2011 (CSA, 2014)
  - ←lack of adequate skills
  - ←Supply-demand mismatch/ disconnection of labor market
- Textile and Garment is a major manufacturing sector in Ethiopia
  - ←It is Ethiopian government's priority sector for export promotion, together with leather sector
  - ←The Ethiopian textile and garment industry has the highest number of trainers and trainees at governmental TVET Institutes (Federal TVET Agency, 2015).
  - ← Ethiopian textile industry contributes nearly 2 percent to GDP and 36 percent to the country's industrial production.

Chain #	Area of operation	Number of factories
0	Cotton farming	10
1	Ginning	9~18
2	Integrated textile mills	20
3	Spinning	8
4	Weaving and knitting	12
5	Handloom (medium size)	6
6	Dyeing and printing	3
7	Blanket factory	6
8	Garment factory (knitted/woven)	60~80

Research questions

1. Expectation on skills

- What kind of skills are expected for the entry-level workers in garment industry?
  - Is there any perception gap of vocational skill between the supply and demand sides of workers?
  - To what extent stakeholders' demographics (e.g. education/experience) affect their perception of vocational skill?

2. Skill development and work performance

- Do garment workers really have the skill they are expected?
  - Are TVET graduates more competent than on-the-job trainees?
  - Do the modes of training affect the types of tasks workers can do?
  - Are there any patterns in the combination of cognitive, behavioral, and vocational skills which yield better performance?

Strategies of designing data collection tools

To develop the module to identify:

(1) Domains of skills which they are strong / weak at

→Need to cover the potentially relevant skills of garment production comprehensively

<Garment-specific vocational skills>

- Ethiopian occupational standard (Ethiopia Ministry of Education, 2011)
- Ask for expert comments (Prof. Shoda, Bunka Fashion College, Japan; factory managers met in Dec. 2015)

<Soft skills>

- Problem-solving skills
- Interpersonal skills
- Work ethics/ habit – KAIZEN

<Literacy and Numeracy>

- Reading, Writing, Speaking in English, Amharic, and Oromifa

(2) Domains of mismatch between training and skills demand

→→ Questionnaire which allow us to see the relationship between the assessment results and the demographics, training background, and institutional context

The idea is to develop a model of "PISA for development" in the field of vocational skills with the case of Ethiopian textile industry

Research site and samples

<Geographic focus of sampling>

Addis Ababa and its vicinity

<Samples>

(1) Garment factories

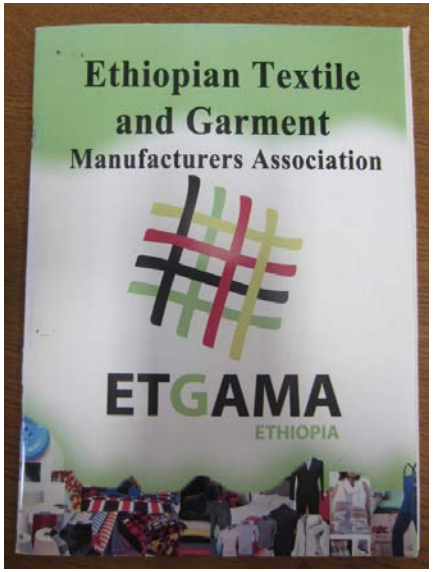
- 13 out of 35 garment factories which are members of the Ethiopia Textile and Garment Manufacture's Association (ETGAMA)

a. Workers of garment factories employed within last 3 years
b. Factory managers

(2) TVET Institutes

- 5 out of 27 public TVET institutes in Addis Ababa which has the largest number of students majoring "Garment Production"
- Nefas Silk (312); Misraq (368); Entoto (378); Tegabarudu (368); General Winget (802)

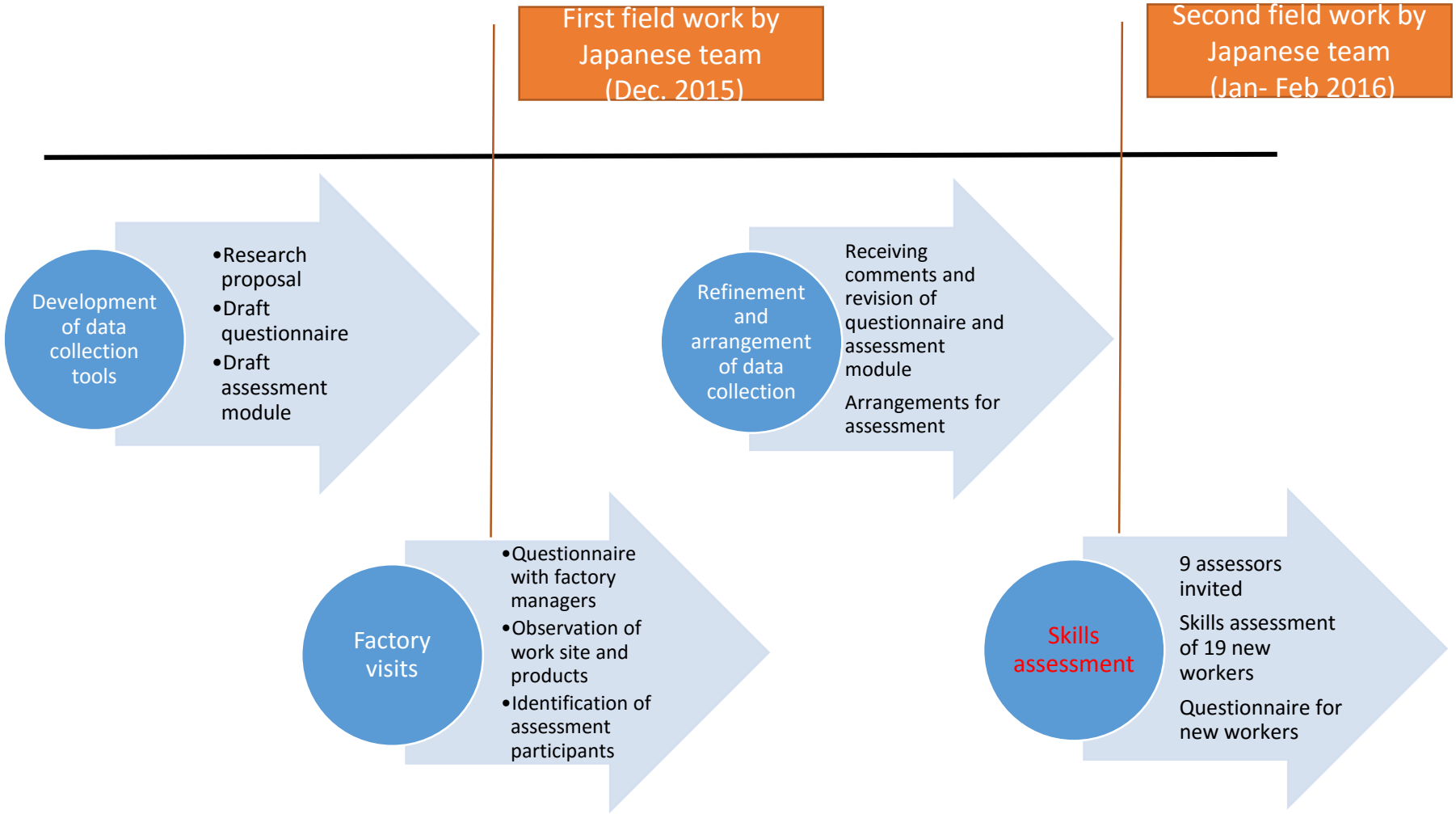
a. Trainers of garment production courses



Sample population

	Research tools	Stakeholder	Number of stakeholders
a)	Questionnaire for factory managers	Factory managers	13
b)	Questionnaire for TVET trainers	TVET College trainers	30
c)	Questionnaire for new employees	Factory new employees	19
d)	Skills assessment for new employees	Factory new employees	19
		Factory managers	3
		TVET College trainers	3
		TIDI trainers	3
e)	Interviews	Factory managers etc	13 – 20?
		TVET College trainers	5 – 10?

Schedule and procedure of data collection



Skills assessment module

- Let new employees of sample factories to perform 4 tasks for the quick assessment of the skills on
  (1) pattern development
  (2) analyzing the structure of the garment
  (3) machine sewing
  (4) ironing (finishing)
- Examinees' performance is graded by
  (1) Trainers of 5 sample TVET institutes
  (2) Trainers' trainers at Textile Industry Development Institute (TIDI) of the Ministry of Industry
  (3) Managers of sample factories

- To examine what the young workers can do instead of examining their mastery of taught knowledge
- Contrast the perceptions on the important occupational skills among different stakeholders (provider of institutionalized education; employers; and experts of governmental institution)

Skills assessment module (cont'd)

	Activity	Skills to be assessed	Points of assessment
I	Draw the pattern of sleeves for a finished shirt	Pattern development	5
II	Compare two shirts and tell differences	Analysis of the garment structure	6
III	Sew small pieces of clothes	Machine sewing	5
IV	Ironing / Pressing	Finishing	4
Total			20

Assessors are requested to grade the performance according to 5 Likert scale

Design of questionnaires

	(a) Factory managers	(b) TVET trainers
Domains of question	Background of the respondent *(5) Characteristics of the factory (12) Training for workers (6) The process of hiring employees (5) Perceived necessity of General skills (29) Perceived necessity of skills in apparel production (20)	Background of the respondent (9) Employment history (5)
Total	77	63

These parts were made identical so that we can compare the perceptions of employers and trainers on skills requirement

	(c) Employees participated in the assessment
Domains of question	Background of the respondent (7) Background of the family (3) Training experience (2) Work experience (6) Current job (12) Skills in apparel production (5) Attitude at work (11)
Total	46

* The number in parenthesis indicates the number of questions assigned for each domain

The analyses to be done

(1) Domains of skills which

- Stakeholders consider to be important
- Assessors' tendencies of grading are similar

→Principle component analysis

(2) Relationships between skills and background of stakeholders

- Comparison of perceptions between employers (factory managers) and TVET trainers ← T-test
- Relationship of the component of skills identified in (1) with demographics, training, and experience of stakeholders

  ← correlation, regression
- Relationship of employees' performance in assessment and their background ← correlation, cross tabulation

Plan of further research

Critically examine the Ethiopian Occupation Standard and curriculum of 5 sample TVET institutes based on the findings from our skills assessment with new employees

- ←Do the certification criteria and training curriculum by the government and TVET institutes match with the skills demanded and performed in the industry?
- ←If not, where exactly does the mismatch happen?
- ←The focus of analysis will be on (1) contents of training; (2) coverage of various domains of skills and knowledge; (3) priorities given to different domains in terms of expected level of skills set for assessment and allocation of resources for training such as teachers, equipment, and time

References

- CSA (2014) The 2014 urban employment unemployment survey. Statistical bulletin. Central statistical agency, Addis Ababa
- Ethiopia Ministry of Education (2011)
- Federal TVET Agency (2015)

Preliminary results: Questionnaire of factory managers, Questionnaire of trainers and Skills assessment

Shoko Yamada, Nagoya University

Christian Otchia, Nagoya University

Kyoko Taniguchi, Hiroshima University

Two parts

I. Questionnaires of factory managers & trainers

II. Skills assessment

Part I. Questionnaires of factory managers & trainers

There are common questions in both questionnaires.

Skills		No. questions	No. questions
General skills	Basic literacy and numeracy skills	10	28
	Others	18	
Skills in apparel production			20
Total			48

The questions in general skills

(1)	Basic numeracy skills	
(2)	Basic speaking skills	English
(3)		Amharic
(4)		Oromifa
(5)		~~Others (Specify……)~~
(6)	Basic reading skills	English
(7)		Amharic
(8)		Oromifa
(9)		~~Others (Specify……)~~
(10)	Basic writing skills	English
(11)		Amharic
(12)		Oromifa
(13)		~~Others (Specify……)~~
(14)	Capacity to develop good relationship with customers	
(15)	Capacity to take initiative	
(16)	Capacity to maintain the work environment safe and clean	
(17)	Skills to identify technical problems	

(18)	Capacity to work in a team
(19)	Punctuality
(20)	Capacity to ask clarification from colleagues
(21)	Capacity to follow the direction of the supervisor
(22)	Capacity to read the market trends
(23)	Capacity to oversee the whole work place
(24)	Capacity to follow the rules
(25)	Capacity to generate innovated ideas
(26)	Capacity to organize time
(27)	Capacity to organize work place
(28)	Skills to find solution to problems
(29)	Timely decision making based on the accurate assessment of work situation
(30)	Capacity to be obedient to what the supervisor was told to do
(31)	Capacity to maintain discipline
(32)	~~Other skills (Specify……)~~

The questions in apparel production skills

(1)	Design garments
(3)	Measure body
(5)	Develop pattern manually
(6)	Develop pattern using CAD system
(10)	Mark, lay-up and cut fabrics
(11)	Perform embroidery manually
(12)	Perform machine embroidery
(13)	Simple sewing
(13)'	Complicated sewing
(14)	Conduct apparel finishing
(15)	Contribute the improvement
(16)	Interact with garment production personnel
(17)	Develop business plan
(18)	Analyze body characteristic of customers
(21)	Perform job estimates and costing
(22)	Perform retailing and sales promotions
(23)	Monitor implementation of work plan/ activities
(24)	Apply quality control
(25)	Improve business practice
(26)	Continuous monitoring and evaluating

Analysis

Exploratory factor analysis (EFA)

Confirmatory factor analysis (CFA)

T-test and correlations

Exploratory factor analysis (EFA)

Basic literacy and numeracy skills

- To examine the hypothesis

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.542
Bartlett's Test of Sphericity	Approx. Chi-Square	229.190
	df	45
	Sig.	.000

3 factors

Communalities		
	Initial	Extraction
q15_1 Basic numeracy	1.000	.565
q15_2 speaking_English	1.000	.933
q15_3 speaking_Amharic	1.000	.896
q15_4 speaking_Oromifa	1.000	.826
q15_6 reading_English	1.000	.828
q15_7 reading_Amharic	1.000	.948
q15_8 reading_Oromifa	1.000	.853
q15_10 writing_English	1.000	.897
q15_11 writing_Amharic	1.000	.788
q15_12 writing_Oromifa	1.000	.722

Rotated Component Matrix[a]			
	Component		
	1	2	3
	Amharic & numeracy	English	Oromifa
q15_7 reading_Amharic	.965	-.095	.088
q15_3 speaking_Amharic	.936	-.135	.036
q15_11 writing_Amharic	.784	.029	.415
q15_1 Basic numeracy	.595	.450	-.088
q15_10 writing_English	-.151	.913	.200
q15_2 speaking_English	-.025	.904	.338
q15_6 reading_English	.060	.872	.252
q15_12 writing_Oromifa	-.093	.144	.832
q15_4 speaking_Oromifa	.276	.347	.793
q15_8 reading_Oromifa	.351	.424	.742

Confirmatory factor analysis (CFA) Basic literacy and numeracy skills

- To adopt the hypothesis and create <u>1 factor</u>

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.542
Bartlett's Test of Sphericity	Approx. Chi-Square	229.190
	df	45
	Sig.	.000

Communalities

	Initial	Extraction
q15_1 Basic numeracy	1.000	.259
q15_2 speaking_English	1.000	.627
q15_3 speaking_Amharic	1.000	.122
q15_4 speaking_Oromifa	1.000	.691
q15_6 reading_English	1.000	.571
q15_7 reading_Amharic	1.000	.176
q15_8 reading_Oromifa	1.000	.782
q15_10 writing_English	1.000	.433
q15_11 writing_Amharic	1.000	.383
q15_12 writing_Oromifa	1.000	.310

	Component
	1
	Basic literacy and numeracy skills
q15_8 reading_Oromifa	.884
q15_4 speaking_Oromifa	.831
q15_2 speaking_English	.792
q15_6 reading_English	.756
q15_10 writing_English	.658
q15_11 writing_Amharic	.619
q15_12 writing_Oromifa	.557
q15_1 Basic numeracy	.509
q15_7 reading_Amharic	.419
q15_3 speaking_Amharic	.349

Exploratory factor analysis (EFA)

The other general skills

- To examine the hypothesis

3 factors

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.791
Bartlett's Test of Sphericity	Approx. Chi-Square	660.364
	df	153
	Sig.	.000

Communalities

	Initial	Extraction
q15_14 customer relation	1.000	.753
q15_15 initiative	1.000	.770
q15_16 work environment	1.000	.858
q15_17 identify problem	1.000	.856
q15_18 teamwork	1.000	.801
q15_19 punctuality	1.000	.632
q15_20 clarification	1.000	.675
q15_21 supervisor direction	1.000	.781
q15_22 market trend	1.000	.653
q15_23 oversight	1.000	.779
q15_24 follow rule	1.000	.717
q15_25 innovation	1.000	.636
q15_26 time organization	1.000	.723
q15_27 organize workplace	1.000	.794
q15_28 problem solving	1.000	.887
q15_29 decision	1.000	.642
q15_30 obedience	1.000	.762
q15_31 discipline	1.000	.810

Rotated Component Matrix[a]

	Component		
	1	2	3
q15_28 problem solving	.928	.162	.009
q15_17 identify problem	.898	.219	.046
q15_23 oversight	.854	.215	.064
q15_27 organize workplace	.840	.268	.126
q15_15 initiative	.839	.251	.049
q15_14 customer relation	.827	.252	-.074
q15_22 market trend	.805	.032	-.068
q15_25 innovation	.797	-.007	.034
q15_26 time organization	.788	.274	.164
q15_18 teamwork	.783	.222	.373
q15_16 work environment	.766	.459	.245
q15_29 decision	.719	.302	.184
q15_20 clarification	.559	.534	.278
q15_30 obedience	.052	.849	-.195
q15_19 punctuality	.137	.783	-.034
q15_21 supervisor direction	.521	.696	.159
q15_31 discipline	.148	.370	-.807
q15_24 follow rule	.454	.343	.627

Confirmatory factor analysis (CFA)
The other general skills

Used

- To adopt the hypothesis and create 2 factors

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.791
Bartlett's Test of Sphericity	Approx. Chi-Square	660.364
	df	153
	Sig.	.000

Communalities

	Initial	Extraction
q15_14 customer relation	1.000	.704
q15_15 initiative	1.000	.757
q15_16 work environment	1.000	.835
q15_17 identify problem	1.000	.836
q15_18 teamwork	1.000	.765
q15_19 punctuality	1.000	.604
q15_20 clarification	1.000	.607
q15_21 supervisor direction	1.000	.736
q15_22 market trend	1.000	.578
q15_23 oversight	1.000	.767
q15_24 follow rule	1.000	.414
q15_25 innovation	1.000	.599
q15_26 time organization	1.000	.723
q15_27 organize workplace	1.000	.793
q15_28 problem solving	1.000	.848
q15_29 decision	1.000	.638
q15_30 obedience	1.000	.758
q15_31 discipline	1.000	.368

Rotated Component Matrix[a]

	Component	
	1	2
	Problem-solving skills	Obedient and discipline
q15_28 problem solving	.913	.122
q15_17 identify problem	.899	.165
q15_18 teamwork	.872	.065
q15_27 organize workplace	.871	.188
q15_23 oversight	.861	.157
q15_16 work environment	.852	.332
q15_15 initiative	.848	.196
q15_26 time organization	.831	.182
q15_14 customer relation	.805	.237
q15_25 innovation	.773	-.042
q15_29 decision	.772	.204
q15_22 market trend	.760	.028
q15_20 clarification	.670	.399
q15_24 follow rule	.635	.107
q15_21 supervisor direction	.622	.591
q15_30 obedience	.100	.865
q15_19 punctuality	.214	.747
q15_31 discipline	-.018	.607

Confirmatory factor analysis (CFA)

Skills in apparel production

- To examine the hypothesis

Used

4 factors

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.678
Bartlett's Test of Sphericity	Approx. Chi-Square	524.034
	df	190
	Sig.	.000

Communalities

	Initial	Extraction
q17_1 garment design	1.000	.695
q17_3 body measurement	1.000	.789
q17_5 pattern development	1.000	.773
q17_6 CAD pattern	1.000	.879
q17_10 lay & cut fabric	1.000	.870
q17_11 embroidery	1.000	.773
q17_12 machine embroidery	1.000	.744
q17_13_1 simple sewing	1.000	.801
q17_13_2 complicated sewing	1.000	.774
q17_14 finishing	1.000	.720
q17_15 improvement	1.000	.743
q17_16 interaction	1.000	.611
q17_17 business plan	1.000	.574
q17_18 analyze body characteristics	1.000	.843
q17_21 costing	1.000	.907
q17_22 retailing & sales promotion	1.000	.804
q17_23 monitoring	1.000	.906
q17_24 quality control	1.000	.941
q17_25 improve practice	1.000	.894
q17_26 continuous M&E	1.000	.917

Rotated Component Matrix[a]

	Component			
	1	2	3	4
	Management	Intermediate skills	Advanced skills	Basic skills
q17_24 quality control	.952	.083	.167	.009
q17_26 continuous M&E	.940	.094	.154	-.032
q17_23 monitoring	.936	.137	.101	-.018
q17_10 lay & cut fabric	.920	.121	.088	.033
q17_25 improve practice	.918	.214	.071	.014
q17_21 costing	.910	.186	.210	.016
q17_15 improvement	.852	-.092	.019	-.096
q17_22 retailing & sales promotion	.833	.180	.147	.236
q17_18 analyze body characteristics	.729	.547	-.066	-.085
q17_17 business plan	.645	.304	.031	.255
q17_14 finishing	.147	.830	.063	-.078
q17_5 pattern development	.342	.799	.080	.101
q17_3 body measurement	.242	.797	.066	.302
q17_12 machine embroidery	-.049	.687	.519	.018
q17_6 CAD pattern	.114	-.025	.919	.146
q17_13_2 complicated sewing	.058	.404	.744	-.231
q17_16 interaction	.338	.058	.693	.118
q17_13_1 simple sewing	-.153	-.107	-.060	.873
q17_1 garment design	.322	.119	.159	.743
q17_11 embroidery	-.071	.529	.051	.697

T-test

- To examine perception gaps between factory managers and trainers

Variable		N	M	SD	SE. M	sig
pca_basic literacy and numeracy skills	Factory managers	13	-.373	1.052	.292	.044
	Trainers	11	.440	.761	.229	
pca1_problem solving skills	Factory managers	13	-.235	1.482	.411	.398
	Trainers	22	.139	.556	.119	
pca2_obedient and discipline	Factory managers	13	.467	.785	.218	.032
	Trainers	22	-.276	1.026	.219	
pca1_management	Factory managers	13	-.001	1.302	.361	.997
	Trainers	12	.001	.578	.167	
pca2_intermediate skills	Factory managers	13	-.409	1.237	.343	.031
	Trainers	12	.443	.315	.091	
pca3_advanced skills	Factory managers	13	-.121	1.174	.325	.540
	Trainers	12	.131	.802	.232	
pca4_basic skills	Factory managers	13	-.391	1.248	.346	.040
	Trainers	12	.423	.325	.094	

Findings

Skills	Perception
Basic literacy and numeracy skills	Factory managers < Trainers
Obedient and discipline	Factory managers > Trainers
Intermediate skills	Factory managers < Trainers
Basic skills (apparel production)	Factory managers < Trainers

Correlations

		status	gender	age	education level	working or teaching experience	pca_basic literacy and numeracy skills	pca1_problem solving skills	pca2_obedient and discipline	pca1_management	pca2_intermediate skills	pca3_advanced skills	pca4_basic skills
status	Pearson Correlation	1	-.401**	-.430**	.139	.086	.414*	.183	-.364*	.001	.435*	.129	.415*
	Sig. (2-tailed)		.008	.004	.375	.585	.044	.293	.032	.997	.030	.540	.039
	N	43	43	43	43	43	24	35	35	25	25	25	25
gender	Pearson Correlation		1	-.042	-.159	-.232	-.350	-.339*	.170	-.286	-.306	-.238	.062
	Sig. (2-tailed)			.791	.309	.134	.094	.047	.328	.165	.137	.253	.769
	N		43	43	43	43	24	35	35	25	25	25	25
age	Pearson Correlation			1	-.132	.263	-.333	-.332	.047	.004	-.272	.102	.035
	Sig. (2-tailed)				.399	.088	.112	.051	.790	.987	.189	.627	.866
	N			43	43	43	24	35	35	25	25	25	25
education level	Pearson Correlation				1	**.679****	.497*	.152	.174	-.081	.186	.211	.105
	Sig. (2-tailed)					.000	.014	.385	.318	.699	.372	.312	.617
	N				43	43	24	35	35	25	25	25	25
working or teaching experience	Pearson Correlation					1	-.130	.154	.166	.290	-.155	-.148	.132
	Sig. (2-tailed)						.545	.376	.342	.159	.460	.481	.531
	N					43	24	35	35	25	25	25	25
pca_basic literacy and numeracy skills	Pearson Correlation						1	.455*	-.171	.283	.409*	.141	-.219
	Sig. (2-tailed)							.029	.434	.271	.103	.588	.398
	N						24	23	23	17	17	17	17
pca1_problem solving skills	Pearson Correlation							1	.000	**.844****	.059	-.176	-.130
	Sig. (2-tailed)								1.000	.000	.800	.445	.573
	N							35	35	21	21	21	21
pca2_obedient and discipline	Pearson Correlation								1	-.004	.119	.387	.121
	Sig. (2-tailed)									.987	.608	.083	.602
	N								35	21	21	21	21
pca1_management	Pearson Correlation									1	.000	.000	.000
	Sig. (2-tailed)										1.000	1.000	1.000
	N									25	25	25	25
pca2_intermediate skills	Pe										1	.000	.000
	Si											1.000	1.000
	N										25	25	25
pca3_advanced skills	Pe											1	.000
	Si												1.000
	N											25	25
pca4_basic skills	Pe												1
	Si												
	N												25

Findings

Skills	Skills	Relationship
Education level	Basic literacy and numeracy skills	+
Basic literacy and numeracy skills	Problem-solving skills	+
Probem-solving skills	Management	++

Part II. Skills assessment

Activity	Points of assessment
I. Draw the pattern of sleeves for a finished shirt	Can draw the rough shapes of the right and left sleeves The drew patterns distinguish the difference of the curve for the front and back sides of the sleeve Can measure and write the rough length **armhole** Can measure and write the rough length of **sleeve cap** Can measure and write the rough length of **sleeve bottom**
II. Compare two shirts and tell differences	**The examinee can point out the differences of :** Width of the body sections of two shirts Length of the body sections Diameters of the sleeves Length of the sleeve from the top Size of the neckline
III. Sew small pieces of clothes	**The examinee can sew two sheets of fabric:** Straightly and consistently 1cm inside the edge Without wrinkles and/or twists With an appropriate tension of the needle and bottom threads **Finishing stitch is:** Straight and consistently within 1.0~1.5mm from the hem Nicely done with a proper thread tension
IV: Ironing / Pressing	The shirt is ironed without wrinkles and distortions Both front and back sides of the shirt are ironed clearly Parts such as pocket, placket, tucks and collar are ironed clearly The shirt is folded flat and clearly

Exploratory factor analysis (EFA)

- To examine the hypothesis

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.817
Bartlett's Test of Sphericity	Approx. Chi-Square	1657.800
	df	190
	Sig.	.000

Communalities

	Initial	Extraction
AI1_Can draw the rough shapes of the right and left sleeves	1.000	.810
AI2_ The drew patterns distinguish the difference of the curve for the front and back sides of the sleeve	1.000	.700
AI3_ Can measure and write the rough length armhole	1.000	.718
AI4_ Can measure and write the rough length of sleeve cap	1.000	.175
AI_5 Can measure and write the rough length of sleeve bottom	1.000	.634
AII1_ Width of the body sections of two shirts	1.000	.679
AII2_ Length of the body sections	1.000	.565
AII3_ Diameters of the sleeves	1.000	.769
AII4_ Length of the sleeve from the top	1.000	.624
AII5_ Size of the neckline	1.000	.733
AII6_ Width of the chest	1.000	.725
AIII1_ Straightly and consistently 1cm inside the edge	1.000	.666
AIII2_ Without wrinkles and/or twists	1.000	.767
AIII3_ With an appropriate tension of the needle and bottom threads	1.000	.671
AIII4_ Straight and consistently within 1.0~1.5mm from the hem	1.000	.621
AIII5_ Nicely done with a proper thread tension	1.000	.738
AIV1_ The shirt is ironed without wrinkles and distortions	1.000	.790
AIV2_ Both front and back sides of the shirt are ironed clearly	1.000	.860
AIV3_ Parts such as pocket, placket, tucks and collar are ironed clearly	1.000	.801
AIV4_ The shirt is folded flat and clearly	1.000	.683

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
	AIII: Sewing	AIV: Ironing	AI: Pattern	AII: Size simple	AII: Size complex
AIII2_ Without wrinkles and/or twists	.850	.159	.127	-.010	.046
AIII5_ Nicely done with a proper thread tension	.816	.225	.083	.096	.066
AIII1_ Straightly and consistently 1cm inside the edge	.779	.033	.210	.105	-.060
AIII3_ With an appropriate tension of the needle and bottom threads	.759	.244	-.008	-.108	.154
AIII4_ Straight and consistently within 1.0~1.5mm from the hem	.724	.152	.037	.257	.079
AIV2_ Both front and back sides of the shirt are ironed clearly	.180	.902	.009	.111	-.036
AIV3_ Parts such as pocket, placket, tucks and collar are ironed clearly	.167	.866	.095	.119	-.025
AIV1_ The shirt is ironed without wrinkles and distortions	.305	.827	.012	.109	.028
AIV4_ The shirt is folded flat and clearly	.120	.758	.163	.030	.259
AI1_Can draw the rough shapes of the right and left sleeves	.115	.106	.873	.024	.153
AI3_ Can measure and write the rough length armhole	.137	.006	.795	.244	-.085
AI2_ The drew patterns distinguish the difference of the curve for the front and back sides of the sleeve	.096	.214	.753	.084	.267
AI_5 Can measure and write the rough length of sleeve bottom	.080	.024	.747	.231	-.126
AI4_ Can measure and write the rough length of sleeve cap	.050	-.037	.326	.162	.196
AII5_ Size of the neckline	.297	.050	.111	.794	-.014
AII6_ Width of the chest	-.016	.151	.332	.765	.085
AII4_ Length of the sleeve from the top	.193	.123	.196	.544	.487
AII2_ Length of the body sections	-.151	.173	.351	.514	.353
AII3_ Diameters of the sleeves	.144	-.008	-.001	.020	.865
AII1_ Width of the body sections of two shirts	-.019	.232	.298	.439	.586

Confirmatory factor analysis (CFA)

- To adopt the hypothesis and create 4 factors

Used

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.817
Bartlett's Test of Sphericity	Approx. Chi-Square	1657.800
	df	190
	Sig.	.000

Communalities

	Initial	Extraction
AI1_Can draw the rough shapes of the right and left sleeves	1.000	.713
AI2_ The drew patterns distinguish the difference of the curve for the front and back sides of the sleeve	1.000	.605
AI3_ Can measure and write the rough length armhole	1.000	.717
AI4_ Can measure and write the rough length of sleeve cap	1.000	.167
AI_5 Can measure and write the rough length of sleeve bottom	1.000	.632
AII1_ Width of the body sections of two shirts	1.000	.664
AII2_ Length of the body sections	1.000	.561
AII3_ Diameters of the sleeves	1.000	.501
AII4_ Length of the sleeve from the top	1.000	.622
AII5_ Size of the neckline	1.000	.412
AII6_ Width of the chest	1.000	.548
AIII1_ Straightly and consistently 1cm inside the edge	1.000	.662
AIII2_ Without wrinkles and/or twists	1.000	.763
AIII3_ With an appropriate tension of the needle and bottom threads	1.000	.642
AIII4_ Straight and consistently within 1.0~1.5mm from the hem	1.000	.603
AIII5_ Nicely done with a proper thread tension	1.000	.737
AIV1_ The shirt is ironed without wrinkles and distortions	1.000	.788
AIV2_ Both front and back sides of the shirt are ironed clearly	1.000	.853
AIV3_ Parts such as pocket, placket, tucks and collar are ironed clearly	1.000	.798
AIV4_ The shirt is folded flat and clearly	1.000	.644

	Component			
	1	2	3	4
	AIII: Sewing	AIV: Ironing	AI: Pattern	AII: Size
AIII2_ Without wrinkles and/or twists	.851	.115	.157	.026
AIII5_ Nicely done with a proper thread tension	.817	.088	.224	.109
AIII1_ Straightly and consistently 1cm inside the edge	.777	.237	.034	.020
AIII3_ With an appropriate tension of the needle and bottom threads	.761	-.056	.238	.043
AIII4_ Straight and consistently within 1.0~1.5mm from the hem	.725	.071	.153	.222
AI3_ Can measure and write the rough length armhole	.135	.829	.009	.111
AI1_Can draw the rough shapes of the right and left sleeves	.115	.816	.101	.153
AI_5 Can measure and write the rough length of sleeve bottom	.077	.787	.028	.071
AI2_ The drew patterns distinguish the difference of the curve for the front and back sides of the sleeve	.098	.689	.207	.278
AI4_ Can measure and write the rough length of sleeve cap	.051	.308	-.040	.262
AIV2_ Both front and back sides of the shirt are ironed clearly	.180	.033	.904	.052
AIV3_ Parts such as pocket, placket, tucks and collar are ironed clearly	.167	.116	.867	.067
AIV1_ The shirt is ironed without wrinkles and distortions	.306	.024	.827	.097
AIV4_ The shirt is folded flat and clearly	.124	.110	.752	.227
AII1_ Width of the body sections of two shirts	-.012	.257	.223	.740
AII4_ Length of the sleeve from the top	.198	.199	.118	.727
AII3_ Diameters of the sleeves	.155	-.162	-.027	.671
AII2_ Length of the body sections	-.148	.366	.171	.613
AII6_ Width of the chest	-.017	.447	.157	.568
AII5_ Size of the neckline	.296	.261	.059	.503

Correlations

		category	gender	age	edu	working experience	pca2_fc1_AIII Sew small pieces of clothes	pca2_fc2_AIV Ironing / Pressing	pca2_fc3_AI Draw the pattern of sleeves for a finished shirt	pca3_fc4_AII Compare two shirts and tell differences
category	Pearson Correlation	1	.274**	.134	0.000	.066	.244**	-.011	.133	.166*
	Sig. (2-tailed)		.000	.082	1.000	.388	.002	.895	.102	.041
	N	171	171	171	171	171	152	152	152	152
gender	Pearson Correlation		1	-.460**	-.395**	-.372**	.182*	-.003	-.040	.149
	Sig. (2-tailed)			.000	.000	.000	.024	.969	.628	.067
	N		171	171	171	171	152	152	152	152
age	Pearson Correlation			1	.083	**.893****	.089	-.061	.237**	-.075
	Sig. (2-tailed)				.283	.000	.278	.455	.003	.358
	N			171	171	171	152	152	152	152
edu	Pearson Correlation				1	-.221**	-.210**	.041	-.344**	.009
	Sig. (2-tailed)					.004	.009	.619	.000	.911
	N				171	171	152	152	152	152
working experience	Pearson Correlation					1	.114	-.026	.306**	-.085
	Sig. (2-tailed)						.161	.750	.000	.298
	N					171	152	152	152	152
pca2_fc1_AIII Sew small pieces of clothes	Pearson Correlation						1	.000	.000	.000
	Sig. (2-tailed)							1.000	1.000	1.000
	N						152	152	152	152
pca2_fc2_AIV Ironing / Pressing	Pearson Correlation							1	.000	.000
	Sig. (2-tailed)								1.000	1.000
	N							152	152	152
pca2_fc3_AI Draw the pattern of sleeves for a finished shirt	P								1	.000
										1.000
										152
pca3_fc4_AII Compare two shirts and tell differences										1
										152

Findings Weak relationship

Skills	Skills	Relationship
Education level	AI Draw the pattern of sleeves for a finished shirt	-
Working experience	AI Draw the pattern of sleeves for a finished shirt	+